INDEX.

Academy of Natural Sciences 353
Accidents. The Scope of Governmental Interference for the Prevention of. Editorial 73
Adulterations in Butter, Detecting 354
Air, Carbonic Acid in 231
Air, Compressed, in Mining Operations 403
Air, Hot, Signal Pipes 321
Algeria 374
Alkali and Bleaching Powders of the District of Glasgow 49, 133
Alkalies in the United States 13
Alloy of Iron, New 413
American Scientific and Technical Journals. Editorial 145
Animals and Vegetables, Zinc in 370
Armor Plate Experiments at Spezia 177
Art of Projecting. Prof. A. E. Dolbear 232
Artificial Lighting of Rooms 228
Assaying and Metallurgy of Precious Metals used in Coinage 281, 339
Awards, System of, at the International Exhibition of 1876 14
Award of prizes 362

Bars, Furnace 315
Baldwin Locomotive Works, Steam Street Car 379
Bleaching Powder, Alkali and, Manufacture of the District of Glasgow 49, 133
Block System of Signals, Safety of Railroad Traffic as ensured by 187
Boilers, Steam, Loss of Heat by Radiation from. J. C. Hoadley 233
Boiler Explosions due to Grease and Lime 302
Boiler, Lancashire 197, 241

Book Notices:

Art of Projecting. Prof. A. E. Dolbear 232
Elements of Geometry. G. M. Searle, C. S. P. 305
Encyclopædia of Chemistry. J. B. Lippincott & Co 160
History of the Iron Manufacture of the American Colonies. John B. Pearse, A. M 154
Graphical Analysis of Roof Trusses, by Chas. E. Greene 160
Text-Book of Mineralogy. Prof. E. S. Dana 306
Brakes, Continuous, for Railroad Trains 296
Briggs, Robt., C. E. Flow of Water through a Pierced Plate 123
Briggs, Robt., C. E. Hipp's Chronograph 89

Briggs, Robt , C. E. Saccharometer or Polariscope of M. Laurent 37
British Scientific Progress 216
Browning of Iron 227
Bust of John Struthers 9
Butter, Detecting Adulterations in 354

Calorific Intensity of Solar Rays. M. A. Crova 351
Carbon for Electric Light 327
Carbon Points for the Electric Light 216
Carbonic Acid in Air 231
Carbonic Acid in Sea Water 370
Cement, White 369
Ceramic Manufacture 251
Ceramics. Prof. P. E. Chase 425
Chase, Prof. P. E. Ceramics 425
Chase, Prof. P. E. Inventions of the Century 274
Chase, Prof. P. E Ornamental Iron Work 355
Chemical Arts, Development of the. Dr. A. W. Hofmann 64, 212, 265, 328, 414
Chemistry, Encyclopædia of 160
Chimneys, Tall, and Electric Conductors 118
Chronograph, the Hipp. Robt. Briggs, C. E 89
City Streets, Best Arrangement of. Prof. L. M. Haupt 252
Clocks, A New Method of Synchronizing 227
Conductivity, Heat, of Metals and Paper 337
Consuming Smoke in Locomotive Engine 174
Continuous Brakes for Railroad Trains 296
Combustion, Temperatures of 301
Cometary Spectrum 303
Committee on Library, Report of 8
Committee on Models, Report of 82
Committee on Primary Industrial Education, Report of 221
Committee on Science and the Arts, Report of 83
Compressed Air in Mining Operations. M. F. L. Cornet. Translated by Robert Zahner 403
Compressed Incandescent Gases, Action of 373
Cornet, M. F. L. Considérations sur la Production et l'Emploi de l'Air Comprimé dans les travaux d'exploitation des mines 403
Cosmical Dust 365
Cost of Railway Improvements in Europe 175
Crova, M. A. Calorific Intensity of Solar Rays 351
Cutting Cast Iron Tubes of Large Calibre 397
Cylindrical Holtz Machine. Prof. E. Thomson 207

Dana, Prof. E. S. Text-Book of Mineralogy 306
Damp Air, Star-Twinkling in 231
Davey Movement for Valves of Pumping Engines 12
Denayrouze, L., and P. Jablochkoff. Divisibility of Electric Light 371
Detonators, Submarine 375
Diatoms in Wheat Straw 11

Direct Process, Iron Making by 121
Disinfectants 63
Divisibility of Electric Light. L. Denayrouze and P. Jablochkoff 371
Dolbear, Prof. A. E. Art of Projecting 232
Dust, Cosmical 365

Editorial:

American Scientific and Technical Journals 145
Motive Power of International Exhibition 1
The Scope of Governmental Interference for the Prevention of Accidents 78
Elasticity, Secondary 369
Election of Officers of the Franklin Institute 85
Electric Conductors, Tall Chimneys and 118
Electric Light Apparatus 264
Electric Light, Carbon Points for 216
Electric Light, Carbon for 327
Electric Light, Divisibility of 371
Electric Light, Spectrum of 373
Electric Lighting 211
Ellis, A. J. Tonometry 101
Encyclopædia of Chemistry 160
Engine, Rotative Water-Pressure 398
Escapement of the Hipp Chronograph 89
Europe, Sugar Production in 302
Exhaust Nozzle, Shaw's Spiral 366
Exhibition, Centennial, Tests of Turbine Water-Wheels at the 316
Exhibition, International, Motive Power of. Editorial 1
Exhibition, International, of 1876, System of Awards at 14
Experiments, The Latest Armor Plate 177
Explosions, Boiler, due to Grease and Lime 302

Fletcher, L. E. Lancashire Boilers 197, 241
Flow of Solids. Lewis S. Ware, C. E 418
Flow of Water through a Pierced Plate. Robt. Briggs, C. E 123
Furnace Bars 315
Furnace of Locomotive Engine, Consuming Smoke in 174
Franklin Institute. Instruction at 7
Franklin Institute. Nomination of Officers 10
Franklin Institute. Proceedings of Meetings 8, 77, 148, 217, 291, 363
Franklin Institute. Secretary's Report. Ventilating Apparatus 193
Franklin Institute. Secretary's Report. Shaw's Spiral Exhaust Nozzle 366
Franklin Institute. Secretary's Report. Steam on Street Railways 379
Franklin Institute. Secretary's Report. Transparent Gold 368
French Industrial Machinery 390
French Postage Stamps 362
French Railway System 120
Friction of Plain Slide Valves. John W. Hill, M. E 182

Galloupe, Francis E. Modern American Locomotive Engineering..... 21, 106, 161, 258, 307, 391
Gas Supply from Works without a Gasholder. M. Servier..... 188
Gases, Action of Compressed Incandescent..... 373
Gears, Teeth of Internal..... 17
Geometry, Elements of..... 305
Glass, Irridescent..... 230
Glass, Manufacture of Toughened..... 45
Glycogenesis..... 301
Gold, Transparent. Secretary's Report..... 368
Governmental Interference, Scope of, for the Prevention of Accidents..... 73
Graphical Analysis of Roof Trusses. Chas. E. Greene, A.M..... 160
Greene, Chas. E. Graphical Analysis of Roof Trusses..... 160

Hardening of Steel..... 299
Haupt, Prof. L. M. The Best Arrangement of City Streets..... 252
Haupt, Prof. L. M. Street Pavements..... 323
Heat Conductivity of Metals and Paper..... 337
Heat, Effect of, on Voltaic Circuits..... 298
Heat, Loss of, by Radiation from Steam-Boilers. J. C. Hoadley..... 233
Heat, Utilizing Solar..... 251
Heating Railway Carriages..... 196
Hill, John W. Friction of Plain Slide Valves..... 182
Hoadley, J. C. Loss of Heat by Radiation from Steam Boilers..... 233
Hofmann, Dr. A. W. Development of the Chemical Arts..... 64, 212, 265, 328, 414
Holtz Machine, Cylindrical. Prof. Elihu Thomson..... 207
Horse Shoe, New..... 303
Hydrogen and its Substitutes for the Lime-Light..... 209

Incandescent Gases, Action of Compressed..... 373
India Ink..... 338
Industrial Art, Pennsylvania Museum and School of..... 85
Industrial Education, Primary, Report of Committee on..... 221
Industrial Machinery, French..... 390
Industrial Society of Mulhouse..... 229
Instruction at the Franklin Institute..... 7
Internal Gears, Teeth of..... 17
Inventions of the Century. Prof. P. E. Chase..... 274
Improvements in Venice, Proposed..... 231
Iodine, Production of, by Distillation of Seaweed..... 72
Iron, Browning of..... 227
Iron, History of the Manufacture of, in the American Colonies. John B. Pearse. 154
Iron Making by Direct Process..... 121
Iron, New Alloy of..... 413
Iron Work, Ornamental..... 355
Irridescent Glass..... 230

Jablochkoff, P., and L. Denayrouze. Divisibility of Electric Light..... 371
Jetties, The Working of the Mississippi..... 181
Jones, Washington. Rotative Water-Pressure Engine..... 398
Journals, American Scientific and Technical. Editorial..... 145

Knight, J. B. A New Form of Megascope..... 335
Knight, J. B. Pennsylvania Museum and School of Industrial Art..... 85

Lancashire Boiler. L. E. Fletcher..... 197, 241
Laurent, M., Saccharometer or Polariscope of..... 37
Lectures on the Weather and its Laws..... 13
Lectures on Technical Mechanics..... 48
Library, Report of Committee on..... 81
Light, Electric, Apparatus..... 264
Light, Velocity of..... 377
Lighting, Electric..... 211
Lighting of Rooms, Artificial..... 228
Lime Light, Hydrogen and its Substitutes for..... 209
Line, Marine Sounding..... 378
Locomotive Engineering, Modern American. F. E. Galloupe, S. B.....
21, 106, 161, 258, 307, 391

Machinery, French Industrial..... 390
Machine, Planing, Slotting and Shaping..... 295
Mactear, Jas. Alkali and Bleaching Powder Manufacture of the District of Glasgow..... 49, 133
Magnetic and Meteorological Disturbances, Relation between..... 337
Magnetic Polarization, Rotary..... 230
Manganese, Use of, in Clarifying Sugar..... 230
Manufacture, Improvement in Ceramic..... 251
Mansfield, A. K. Teeth of Internal Gears..... 17
Marine Sounding Line..... 378
Mechanics, Lectures on Technical..... 48
Mechanical Stoking..... 370
Megascope, A New Form of. J. B. Knight..... 335
Metallurgy and Assaying of Precious Metals used in Coinage. A. E. Outerbridge, Jr..... 281, 339
Meteorologic and Magnetic Disturbances, Relation between..... 337
Mineralogy, Text-Book of. Prof. E. S. Dana..... 306
Mining Operations, Use of Compressed Air in..... 403
Mississippi Jetties, Working of the..... 181
Models, Report of Committee on..... 82
Motive Power of the International Exhibition. Editorial..... 1
Mulhouse, Industrial Society of..... 229

Natural Sciences, Academy of..... 353
Nobili's Rings, A new kind of..... 378
Nomination for Officers of the Franklin Institute..... 10

Old Rails, What shall be done with them 336
Organic Phosphorescence 367
Ornamental Iron Work. Prof. P. E. Chase 355
Origin of Petroleum 192
Outerbridge, A. E., Jr. The Metallurgy and Assaying of the Precious Metals used in Coinage 281, 339

Pantopollite 377
Paris, Cost of Street Cleaning in 230
Passenger Traffic, Centennial, of the Pennsylvania R. R. 226
Pavements, Street. Prof. L. M. Haupt 323
Pearse, Jno. B. History of the Iron Manufacture of the American Colonies 154
Pennsylvania Museum and School of Industrial Art, Report on. J. B. Knight 85
Pennsylvania Rail Road, Centennial Passenger Traffic of the 226
Petroleum, Origin of 192
Phosphorescence, Organic 367
Planing, Slotting and Shaping Machine 295
Postage Stamps, New French 362
Polariscope, Saccharometer or, of M. Laurent 37
Polarization, Rotary Magnetic 230
Practical Tunneling 114
Precious Metals used in Coinage, Metallurgy and Assaying of 281, 339
Prize to Sir Wm. Thomson 302
Prizes, Award of 362
Proceedings of Meetings of the Franklin Institute 8, 77, 148, 217, 291, 363
Projecting, Art of 232
Pumping Engines at Lawrence, Mass., Trial of. T. Skeel, C.E. 29
Pumping Engines, Davey Valve Movement of 12

Radiation from Steam Boilers, Loss of Heat by. J. C. Hoadley 233
Rails, Old, What shall be done with them 336
Railroad Trains, Continuous Brakes for 296
Railroad Traffic, Safety of . . by Block System of Signals 187
Railway Carriages, Heating 196
Railway Improvements, Cost of, in Europe 175
Railway, St. Gothard 257
Railway System, French 120
Refining Silver 303
Report of Committee on Primary Industrial Education 221
Report of Committee on Models 82
Report of Committee on Library 81
Report of Committee on Science and the Arts 83
Reservoirs of the Rio Rimac 376
Rings, a new kind of Nobili's 378
Roll Turning 191
Rotary Magnetic Polarization 230
Rotative Water-Pressure Engine 398
Roof Trusses, Graphical Analysis of 160

Saccharometer or Polariscope of M. Laurent. Robt. Briggs, C. E..... 37
Scientific and Technical Journals. Editorial..... 145
Searle, G. M., Elements of Geometry..... 305
Seaweed, Production of Iodine by Distillation of..... 72
Sea Water, Carbonic Acid in..... 370
Secondary Elasticity..... 363
Scientific Progress, British..... 216
Secretary's Report, Transparent Gold..... 368
Secretary's Report, Shaw's Spiral Exhaust Nozzle..... 366
Secretary's Report, Steam on Street Railways..... 379
Sellers, Coleman, System of Awards at the International Exhibition of 1876..... 14
Servier, M., Gas Supply from Works without a Gasholder..... 188
Shaw's Spiral Exhaust Nozzle..... 366
Signals, Safety of Railroad Traffic as ensured by the block system of..... 187
Signal Pipes, Hot Air..... 321
Silver Refining..... 303
Skeel, Theron, C. E. Trials of Pumping Engines at Lawrence, Mass..... 29
Slide Valves, Friction of Plain. J. W. Hill..... 182
Smoke, Consuming, in Furnace of Locomotive Engine..... 174
Solids, Flow of..... 418
Solar Rays, Calorific Intensity of..... 351
Solar Heat, Utilizing..... 251
Sounding Line, Marine..... 378
Spectrum of Electric light..... 373
Spectrum, Cometary..... 303
Spezia, Latest Armor Plate Experiments at..... 177
Springs, Sulphur, Formation of..... 230
Star-Twinkling in Damp Air..... 231
Steam on Street Railways..... 379
Steel, Hardening of..... 299
St. Gothard Railway..... 257
Stoking, Mechanical..... 370
Streets, Best Arrangement of City..... 252
Street Cleaning in Paris, Cost of..... 230
Street Pavements. Prof. L. M. Haupt..... 328
Street Railways, Steam on..... 379
Street Tramways..... 322
Struthers, John, Bust of..... 9
Submarine Detonators..... 375
Sugar Production in Europe..... 302
Sugar, Clarifying, Use of Magnesia in..... 230
Sulphur Springs, Formation of..... 230
Synchronizing Clocks, A New Method of..... 227

Tannate of Iron, Wood Preserved by Injecting..... 376
Teeth of Internal Gears. A. K. Mansfield, M. E..... 17
Temperatures of Combustion..... 301
Temperature and Viscosity, Relation between..... 338
Tests of Turbine Water-Wheels at Centennial Exhibition..... 316

Thomson, Prof. Elihu. Cylindrical Holtz Machine..... 207
Thomson, Sir William, Prize to..... 302
Tonometry. A. J. Ellis..... 101
Toughened Glass, Manufacture of..... 45
Tubes, Cutting Cast Iron, of Large Calibre..... 397
Tunneling, Practical..... 114
Turbine Water-Wheels, Test of, at the Centennial Exhibition..... 316
Turin, Water Supply of..... 303
Turning, Roll..... 191
Tramways, Street..... 322
Transparent Gold..... 368

United States, Alkalies in the..... 13

Valves of Pumping Engines, The Davey Movement of..... 12
Velocity of Light..... 377
Venice, Proposed Improvements in..... 231
Ventilating Apparatus. From Secretary's Report..... 193
Viscosity and Temperature, Relation between..... 338
Voltaic Circuits, Effects of Heat on..... 298

Ware, Lewis S. Flow of Solids..... 418
Water Supply of Turin..... 303
Water, the Flow of, through Pierced Plates. Robert Briggs, C.E..... 123
Water-Pressure Engine, Rotative. Washington Jones, M.E..... 398
Water-Wheels, Tests of Turbine, at the Centennial Exhibition..... 316
Weather and its Laws, Lectures on the..... 13
Welsh, Wm. Ventilating Apparatus..... 193
Wheat Straw, Diatoms in..... 11
White Cement..... 369
Wood preserved by Injecting Tannate of Iron..... 376
Works, Public, etc., of Algeria..... 374

Zahner, Robert. Compressed Air in Mining Operations..... 403
Zinc in Animals and Vegetables..... 370